the peak point. In addition, when the Raman spectrum analyzer **110** analyzes the Raman spectrum of the user B, the Raman spectrum of the user B may have a maximum peak point in the vicinity of 700 cm^{-1}, and extract 31,500 a.u as a maximum value of the peak point. The Raman spectrum analyzer **110** may analyze data extracted from the Raman spectrum as unique characteristic information for each user.

[0050] In addition, the Raman spectrum analyzer **110** may extract peak points, lowest points, the number of the peak points, the number of the lowest points, the intensity of the peak points, variation in the intensity, a mean value of the intensity within a range of a wave number, a deviation from the peak point, and other feature points from each of the Raman spectrums, and analyze the extracted data as the user characteristic information.

[0051] Moreover, in an exemplary embodiment, the Raman spectrum analyzer **110** may analyze the user characteristic information using a graph outline analysis method using an image processing technique, a statistical data extraction method, and a quantitative or qualitative analysis method of the Raman spectrum.

[0052] The authenticator **120** may authenticate a user based on the analysis result of the Raman spectrum analyzer **110**. For example, when the Raman spectrum analyzer **110** analyzes the user characteristic information from the Raman spectrum, the authenticator **120** may determine whether the extracted data coincides with user characteristic information stored in advance based on the analysis result, and authenticate a user's identity using the user authentication apparatus **100**.

[0053] FIG. **2** is a block diagram illustrating the user authentication apparatus **200** according to another exemplary embodiment. Referring to FIG. **2**, the user authentication apparatus **200** includes a light source **210**, a Raman spectrum acquirer **220**, a Raman spectrum analyzer **230**, an authenticator **240**, a storage **250**, and an information provider **260**. Hereinafter, description of duplicate components in an exemplary embodiment of FIG. **2** will be simplified.

[0054] The light source **210** may irradiate a user's skin with a single light. In this case, the single light may be a short wavelength light such as a laser.

[0055] The Raman spectrum acquirer **220** may receive light reflected from the user's skin, and acquire a Raman spectrum from the received light.

[0056] As an example, the user authentication apparatus **200** may be mounted or embedded in a hardware device such as a spectrometer including the light source **210** and the Raman spectrum acquirer **220** or a Raman spectroscope. In this case, the spectrometer or the Raman spectroscope may have a shield layer that blocks the inflow of external light except from a skin contact surface to separate light emitted from the light source **210** therein and light emitted from the outside.

[0057] In an exemplary embodiment, a device and equipment for acquiring the Raman spectrum is not limited to a specific embodiment, and the user authentication apparatus **200** may be mounted in a portable device, a wearable device, a healthcare system, and the like including the light source **210** and the Raman spectrum acquirer **220**.

[0058] According to another exemplary embodiment, the light source **210** may irradiate a user's skin with a single light for a predetermined time, and the Raman spectrum acquirer **220** may acquire a Raman spectrum that is exposed for the predetermined time. At this point, when fluorescence bleaching occurs in the Raman spectrum over time, the Raman spectrum analyzer **230** may extract a fluorescence bleaching range and analyze the extracted fluorescence bleaching range as user characteristic information.

[0059] FIG. **4** is a diagram illustrating a range of fluorescence bleaching that occurs after exposure for a predetermined time for each user, according to an exemplary embodiment. When the light source **210** irradiates skin with a single light for the predetermined time, fluorescence may be generated by a protein component among constituent components of the skin, and a fluorescence bleaching phenomenon of a fluorescent material may occur over time. In this case, the fluorescence may constitute the background in the Raman spectrum. Referring to FIG. **4**, it can be seen that a point where fluorescence is generated in the Raman spectrum of each of the user A and the user B and a bleaching range are shown differently from each other depending on the skin constituent component of the user.

[0060] For example, the Raman spectrum analyzer **230** may extract the fluorescence bleaching range in which a CCD count or an intensity is reduced although the type of the Raman spectrum is the same before and after exposure for several seconds to several minutes, as the user characteristic information.

[0061] As an example, referring to view (A) of FIG. **4**, when the light source **210** irradiates skin of the user A with a single light, the Raman spectrum acquirer **220** may acquire the Raman spectrum as shown in view (A) of FIG. **4**. The Raman spectrum analyzer **230** may extract 2,000 a.u that is a maximum value of the fluorescence bleaching range from the Raman spectrum of the user A, and analyze the fluorescence bleaching range as the characteristic information of the user A. Similarly, the Raman spectrum analyzer **230** may extract 400 a.u that is a maximum value of the fluorescence bleaching range from the Raman spectrum of the user B shown in view (B) of FIG. **4**, and analyze the fluorescence bleaching range as the characteristic information of the user B.

[0062] Referring to FIG. **4**, because the fluorescence bleaching range for each of the user A and the user B may be unique to each user, the fluorescence bleaching range may be used as unique characteristic information for each user.

[0063] According to another exemplary embodiment, the Raman spectrum analyzer **230** may extract either one or both of a principal component composition ratio of the user's skin and feature information of a first principal component from the extracted fluorescence bleaching range. For example, the Raman spectrum analyzer **230** may extract the principal component composition ratio of the user's skin from the fluorescence bleaching range using a principal component analysis method. At this point, the feature information of the first principal component may be feature information about a principal component that occupies the largest proportion of the principal component composition ratio. For example, the Raman spectrum analyzer **230** may extract a principal component such as protein from the fluorescence bleaching range over time, and this may be expressed as the graph of FIG. **5**.

[0064] FIG. **5** is a diagram illustrating a graph related to feature information of a first principal component for each user, according to an exemplary embodiment. Referring to view (A) of FIG. **5**, although the Raman spectrum analyzer **230** has extracted feature information of a first principal component three times on each of a first day and a second